

Appln. No. 09/606,679
Amendment Under 37 C.F.R. § 1.111

AMENDMENTS TO THE CLAIMS^(DNS1)

This listing of claims will replace all prior versions and listings of claims in the application:

LISTING OF CLAIMS:

Claim 1 (original) An electron beam drawing mask blank comprising: a pattern supporting layer for transmitting an electron beam therethrough; an electron beam scattering layer formed over said pattern supporting layer; and a support member for supporting said pattern supporting layer and said electron beam scattering layer, wherein said electron beam scattering layer is made of a material composed substantially of the carbon element and/or the silicon element.

Claim 2 (original) An electron beam drawing mask blank as claimed in claim 1, wherein said electron beam scattering layer is made of a material composed substantially of the carbon element.

Claim 3 (original) An electron beam drawing mask blank as claimed in claim 2, wherein said electron beam scattering layer is made of either a diamond like carbon or a material containing a diamond like carbon doped with at least one of B, N, Si and P.

Claim 4 (original) An electron beam drawing mask blank as claimed in claim 3, wherein the doping of said diamond like carbon with at least one of B, N, Si and P is 0.1 to 40 mole %.

Claim 5 (original) An electron beam drawing mask blank as claimed in claim 1, wherein said electron beam scattering layer is made of a material composed substantially of the silicon element.

Claim 6 (original) An electron beam drawing mask blank as claimed in any of the claims 1 to 5, wherein said pattern supporting layer is made of a material composed substantially of the carbon element.

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Claim 7 (original) An electron beam drawing mask blank as claimed in claim 6, wherein said pattern supporting layer is made of either a diamond like carbon or a material containing a diamond like carbon doped with at least one of B, N, P, Ti, Si and Al.

Claim 8 (original) An electron beam drawing mask blank as claimed in claim 7, wherein the doping of said diamond like carbon with at least one of B, N, P, Ti, Si and Al is 0.1 to 40 mole %.

Claim 9 (original) An electron beam drawing mask blank as claimed in any of the claims 1 to 5, wherein said pattern supporting layer is made of a material composed substantially of the silicon element.

Claim 10 (previously presented) An electron beam drawing mask blank as claimed in claim 1, further comprising an etching stopper layer sandwiched either between said electron beam scattering layer and said pattern supporting layer or between said pattern supporting layer and said support member.

Claim 11 (original) An electron beam drawing mask blank as claimed in claim 10, wherein said etching stopper layer is made of a material having a high etching selection ratio with said electron beam scattering layer and/or said support member.

Claim 12. (previously presented) An electron beam drawing mask blank as claimed in claim 1, wherein said support member is made of a material composed substantially of the carbon element.

Claim 13 (original) An electron beam drawing mask blank comprising: a pattern supporting layer for transmitting an electron beam therethrough; an etching stopper layer formed over said pattern supporting layer; an electron beam scattering layer formed over said etching stopper layer; and a support member for supporting said pattern supporting layer, said etching stopper layer and said electron beam scattering layer, wherein said electron beam scattering layer is made of either a diamond like carbon or a material containing a diamond like carbon doped with at least one of B, N, Si and P; said pattern supporting layer is made of either a diamond like carbon or a material containing a

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diamond like carbon doped with at least one of B, N, P, Ti, Si and Al; and said etching stopper layer is made of a material having a high etching selection ratio with said electron beam scattering layer.

Claim 14 (original) An electron beam drawing mask blank comprising: a pattern supporting layer for transmitting an electron beam therethrough; an electron beam scattering layer formed over said pattern supporting layer; and a support member for supporting said pattern supporting layer and said electron beam scattering layer, wherein said pattern supporting layer has a film thickness of 0.005 to 0.2 micron whereas said electron beam scattering layer has a film thickness of 0.2 to 2 micron so that they are made of materials satisfying these film thickness relations.

Claim 15 (original) An electron beam drawing mask blank as claimed in claim 14, wherein said pattern supporting layer satisfies the following Formula (1)

$$Tt \leq 2\alpha \quad (1),$$

wherein Tt indicates the film thickness of the pattern supporting layer; and α indicates a mean free path of electrons in the pattern supporting layer.

Claim 16 (previously presented) An electron beam drawing mask blank as claimed in claim 14, wherein said electron beam scattering layer satisfies the following Formula (2)

$$2B \leq Ts \leq 10B \quad (2),$$

wherein Ts indicates the film thickness of the electron beam scattering layer; and B indicates a mean free path of electrons in the electron beam scattering layer.

Claim 17 (previously presented) An electron beam drawing mask blank as claimed in any of the claims 14 or 15, wherein said pattern supporting layer and said electron beam scattering layer have film material densities of 1.0 to 5.0 g/cm³.

Claim 18 (previously presented) An electron beam drawing mask blank as claimed in any of the claims 14 to 16, wherein said pattern supporting layer and/or said electron beam scattering layer have elastic moduli of 0.8×10^{11} Pa or higher.

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Claim 19 (previously presented) An electron beam drawing mask blank as claimed in any of the claims 14 to 16, wherein said pattern supporting layer and/or said electron beam scattering layer have a film thickness dispersion of 30 % or less within one shot area.

Claim 20 (previously presented) An electron beam drawing mask blank as claimed in any of the claims 14 to 16, wherein said electron beam scattering layer is made of a material composed substantially of the carbon element and/or the silicon element.

Claim 21 (previously presented) An electron beam drawing mask blank as claimed in any of the claims 14 to 16, further comprising an etching stopper layer sandwiched either between said electron beam scattering layer and said pattern supporting layer or between said pattern supporting layer and said support member.

Claim 22 (original) An electron beam drawing mask blank as claimed in claim 21, wherein said etching stopper layer has a film thickness of 0.005 to 0.2 micron.

Claim 23 (previously presented) An electron beam drawing mask blank as claimed in claim 21, wherein said etching stopper layer has a film material density of 1.0 to 5.0 g/cm³.

Claim 24 (previously presented) An electron beam drawing mask blank as claimed in claim 21, wherein said etching stopper layer is made of a material having a high etching selection ratio with said electron beam scattering layer and/or said support member.

Claim 25 (previously presented) An electron beam drawing mask blank as claimed in any of the claims 14 to 16, wherein at least one layer of said pattern supporting layer, said etching stopper layer and said electron beam scattering layer has a surface roughness (Ra) of 10 nm or lower.

Claim 26 (previously presented) An electron beam drawing mask blank as claimed in any of the claims 14 to 16, wherein either at least one layer of said pattern

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supporting layer, said etching stopper layer and said electron beam scattering layer is stress-controlled by a heat treatment, or at least two layers are simultaneously subjected to a heat treatment to control the film stress thereby to reduce the total film stress.

Claim 27 (previously presented) An electron beam drawing mask, manufactured by using the mask blank as claimed any of the claims 1 to 5 and 13 to 16.

Claim 28 (original) An electron beam drawing mask comprising: a pattern supporting film for transmitting an electron beam therethrough; an electron beam scattering body pattern formed over said pattern supporting film; and a support member for supporting said pattern supporting film and said electron beam scattering body pattern, wherein said pattern supporting film has a film thickness of 0.005 to 0.2 micron, a film material density of 1.0 to 5.0 g/cm³ and an elastic modulus of 0.8×10^{11} Pa or higher; and said electron beam scattering body pattern has a film thickness of 0.2 to 2 micron, a film material density of 1.0 to 5.0 g/cm³, and an elastic modulus of 0.8×10^{11} Pa or higher.

Claim 29 (original) An electron beam drawing mask comprising: a pattern supporting film for transmitting an electron beam therethrough; an electron beam scattering body pattern formed over said pattern supporting film; and a support member for supporting said pattern supporting film and said electron beam scattering body pattern, wherein at least one of said support member, said pattern supporting film and said electron beam scattering body pattern is made of a material composed substantially of the carbon element.

Claim 30 (original) An electron beam drawing mask comprising: a pattern supporting film for transmitting an electron beam therethrough; an electron beam scattering body pattern formed over said pattern supporting film; an etching stopper layer formed all over said pattern supporting film or left under said electron beam scattering body pattern; and a support member for supporting said pattern supporting film, said etching stopper layer and said electron beam scattering body pattern, wherein said electron beam scattering body pattern is made of either a diamond like carbon or a

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material containing a diamond like carbon doped with at least one of B, N, Si and P; said pattern supporting film is made of either a diamond like carbon or a material containing a diamond like carbon doped with at least one of B, N, P, Ti, Si and Al; and said etching stopper layer is made of a material having a high etching selection ratio with said electron beam scattering layer.

Claim 31 (original) An electron beam drawing mask comprising: a pattern supporting film for transmitting an electron beam therethrough; an electron beam scattering body pattern formed over said pattern supporting film; and a support member for supporting said pattern supporting film and said electron beam scattering body pattern, wherein: said electron beam scattering body pattern is made of a material composed substantially of the silicon element; and said pattern supporting film is made of SiC or TiC.

Claim 32 (original) An electron beam drawing mask comprising: a pattern supporting film for transmitting an electron beam therethrough; an etching stopper layer formed over said pattern supporting film; an electron beam scattering body pattern formed over said etching stopper layer; and a support member for supporting said pattern supporting film, said etching stopper layer and said electron beam scattering body pattern, wherein said electron beam scattering body pattern is made of hard carbon; said etching stopper layer is made of SiO_2 ; and said pattern supporting film is made of a material composed substantially of the silicon element.

Claim 33 (original) An electron beam drawing mask comprising: a pattern supporting film for transmitting an electron beam therethrough; an electron beam scattering body pattern formed over said pattern supporting film; and a support member for supporting said pattern supporting film and said electron beam scattering body pattern, wherein said electron beam scattering body pattern is made of either a diamond like carbon or a material containing a diamond like carbon doped with at least one of B, N, Si and P; said pattern supporting film is made of R-SiC.

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Claim 34 (original) An electron beam drawing mask comprising: a pattern supporting film for transmitting an electron beam therethrough; an electron beam scattering body pattern formed over said pattern supporting film; and a support member for supporting said pattern supporting film and said electron beam scattering body pattern, wherein said electron beam scattering body pattern is made of a material composed substantially of the silicon element; and said pattern supporting film is made of SiC.

Claim 35 (original) An electron beam drawing mask comprising: a pattern supporting film for transmitting an electron beam therethrough; an electron beam scattering body pattern formed over said pattern supporting film; and a support member for supporting said pattern supporting film and said electron beam scattering body pattern, wherein said electron beam scattering body pattern is made of a material composed substantially of the silicon element; and said pattern supporting film is made of either a diamond like carbon or a material containing a diamond like carbon doped with at least one of B, N, P, Ti, Si and Al.

Claim 36 (currently amended): An electron beam drawing mask as claimed in any of the claims 28 to 35, wherein said electron beam drawing mask is adapted for use at an acceleration voltage of an exposure electron beam of 30 KeV or higher.

Claim 37 (previously presented) A method for manufacturing an electron beam drawing mask, comprising the step of forming at least one of a compressive stress film and a tensile stress film on the surface side or back side of the electron beam drawing mask as claimed in any of the claims 27 to 35.

Claim 38 (original) A method for manufacturing an electron beam drawing mask, comprising the steps of subjecting an SIMOX wafer or an adhered SOI wafer to a wind treatment from the back side; subsequently removing a stopper layer (or an intermediate layer) in the wafer selectively; and forming a pattern supporting film on one side from the back side by a thin film forming method.

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Claim 39 (previously presented) A semiconductor device, manufactured by using an electron beam drawing mask as claimed in any of the claims 27 to 35.

Claim 40 (previously presented) An electron beam drawing mask blank as claimed in claim 2, further comprising an etching stopper layer sandwiched either between said electron beam scattering layer and said pattern supporting layer or between said pattern supporting layer and said support member.

Claim 41 (previously presented) An electron beam drawing mask blank as claimed in claim 3, further comprising an etching stopper layer sandwiched either between said electron beam scattering layer and said pattern supporting layer or between said pattern supporting layer and said support member.

Claim 42 (previously presented) An electron beam drawing mask blank as claimed in claim 4, further comprising an etching stopper layer sandwiched either between said electron beam scattering layer and said pattern supporting layer or between said pattern supporting layer and said support member.

Claim 43 (previously presented) An electron beam drawing mask blank as claimed in claim 5, further comprising an etching stopper layer sandwiched either between said electron beam scattering layer and said pattern supporting layer or between said pattern supporting layer and said support member.

Claim 44 (previously presented) An electron beam drawing mask blank as claimed in claim 6, further comprising an etching stopper layer sandwiched either between said electron beam scattering layer and said pattern supporting layer or between said pattern supporting layer and said support member.

Claim 45 (previously presented) An electron beam drawing mask blank as claimed in claim 7, further comprising an etching stopper layer sandwiched either between said electron beam scattering layer and said pattern supporting layer or between said pattern supporting layer and said support member.

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Claim 46 (previously presented) An electron beam drawing mask blank as claimed in claim 8, further comprising an etching stopper layer sandwiched either between said electron beam scattering layer and said pattern supporting layer or between said pattern supporting layer and said support member.

Claim 47 (previously presented) An electron beam drawing mask blank as claimed in claim 9 further comprising an etching stopper layer sandwiched either between said electron beam scattering layer and said pattern supporting layer or between said pattern supporting layer and said support member.

Claim 48 (previously presented) An electron beam drawing mask blank as claimed in claim 40, wherein said etching stopper layer is made of a material having a high etching selection ratio with said electron beam scattering layer and/or said support member.

Claim 49 (previously presented) An electron beam drawing mask blank as claimed in claim 41, wherein said etching stopper layer is made of a material having a high etching selection ratio with said electron beam scattering layer and/or said support member.

Claim 50 (previously presented) An electron beam drawing mask blank as claimed in claim 42, wherein said etching stopper layer is made of a material having a high etching selection ratio with said electron beam scattering layer and/or said support member.

Claim 51 (previously presented) An electron beam drawing mask blank as claimed in claim 43, wherein said etching stopper layer is made of a material having a high etching selection ratio with said electron beam scattering layer and/or said support member.

Claim 52 (previously presented) An electron beam drawing mask blank as claimed in claim 44, wherein said etching stopper layer is made of a material

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having a high etching selection ratio with said electron beam scattering layer and/or said support member.

Claim 53 (previously presented) An electron beam drawing mask blank as claimed in claim 45, wherein said etching stopper layer is made of a material having a high etching selection ratio with said electron beam scattering layer and/or said support member.

Claim 54 (previously presented) An electron beam drawing mask blank as claimed in claim 46, wherein said etching stopper layer is made of a material having a high etching selection ratio with said electron beam scattering layer and/or said support member.

Claim 55 (previously presented) An electron beam drawing mask blank as claimed in claim 47, wherein said etching stopper layer is made of a material having a high etching selection ratio with said electron beam scattering layer and/or said support member.

Claim 56 (previously presented) An electron beam drawing mask blank as claimed in claim 2, wherein said support member is made of a material composed substantially of the carbon element.

Claim 57 (previously presented) An electron beam drawing mask blank as claimed in claim 3 wherein said support member is made of a material composed substantially of the carbon element.

Claim 58 (previously presented) An electron beam drawing mask blank as claimed in claim 4 wherein said support member is made of a material composed substantially of the carbon element.

Claim 59 (previously presented) An electron beam drawing mask blank as claimed in claim 5, wherein said support member is made of a material composed substantially of the carbon element.

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Claim 60 (previously presented) An electron beam drawing mask blank as claimed in claim 6, wherein said support member is made of a material composed substantially of the carbon element.

Claim 61 (previously presented) An electron beam drawing mask blank as claimed in claim 7, wherein said support member is made of a material composed substantially of the carbon element.

Claim 62 (previously presented) An electron beam drawing mask blank as claimed in claim 8, wherein said support member is made of a material composed substantially of the carbon element.

Claim 63 (previously presented) An electron beam drawing mask blank as claimed in claim 9, wherein said support member is made of a material composed substantially of the carbon element.

Claim 64 (previously presented) An electron beam drawing mask blank as claimed in claim 10, wherein said support member is made of a material composed substantially of the carbon element.

Claim 65 (previously presented) An electron beam drawing mask blank as claimed in claim 40, wherein said support member is made of a material composed substantially of the carbon element.

Claim 66 (previously presented) An electron beam drawing mask blank as claimed in claim 41, wherein said support member is made of a material composed substantially of the carbon element.

Claim 67 (previously presented) An electron beam drawing mask blank as claimed in claim 42, wherein said support member is made of a material composed substantially of the carbon element.

Claim 68 (previously presented) An electron beam drawing mask blank as claimed in claim 43, wherein said support member is made of a material composed substantially of the carbon element.

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Claim 69 (previously presented) An electron beam drawing mask blank as claimed in claim 44, wherein said support member is made of a material composed substantially of the carbon element.

Claim 70 (previously presented) An electron beam drawing mask blank as claimed in claim 45, wherein said support member is made of a material composed substantially of the carbon element.

Claim 71 (previously presented) An electron beam drawing mask blank as claimed in claim 46, wherein said support member is made of a material composed substantially of the carbon element.

Claim 72 (previously presented) An electron beam drawing mask blank as claimed in claim 48, wherein said support member is made of a material composed substantially of the carbon element.

Claim 73 (previously presented) An electron beam drawing mask blank as claimed in claim 49, wherein said support member is made of a material composed substantially of the carbon element.

Claim 74 (previously presented) An electron beam drawing mask blank as claimed in claim 50, wherein said support member is made of a material composed substantially of the carbon element.

Claim 75 (previously presented) An electron beam drawing mask blank as claimed in claim 51, wherein said support member is made of a material composed substantially of the carbon element.

Claim 76 (previously presented) An electron beam drawing mask blank as claimed in claim 52 wherein said support member is made of a material composed substantially of the carbon element.

Claim 77 (previously presented) An electron beam drawing mask blank as claimed in claim 53, wherein said support member is made of a material composed substantially of the carbon element.

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Claim 78 (previously presented) An electron beam drawing mask blank as claimed in claim 54, wherein said support member is made of a material composed substantially of the carbon element.

Claim 79 (previously presented) An electron beam drawing mask blank as claimed in claim 55, wherein said support member is made of a material composed substantially of the carbon element.

Claim 80 (cancelled)

Claim 81 (previously presented) An electron beam drawing mask blank as claimed in claim 17, wherein said pattern supporting layer and/or said electron beam scattering layer have elastic moduli of 0.8×10^{11} Pa or higher.

Claim 82 (previously presented) An electron beam drawing mask blank as claimed in claim 17, wherein said pattern supporting layer and/or said electron beam scattering layer have a film thickness dispersion of 30 % or less within one shot area.

Claim 83 (previously presented) An electron beam drawing mask blank as claimed in claim 17, wherein said electron beam scattering layer is made of a material composed substantially of the carbon element and/or the silicon element.

Claim 84 (previously presented) An electron beam drawing mask blank as claimed in claim 18, wherein said electron beam scattering layer is made of a material composed substantially of the carbon element and/or the silicon element.

Claim 85 (cancelled)

Claim 86 (previously presented) An electron beam drawing mask blank as claimed in claim 19, wherein said electron beam scattering layer is made of a material composed substantially of the carbon element and/or the silicon element.-